A note on ADMM

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I encounter ADMM several time, did go through the derivation 2 times at least, still I cannot write it down from scratch when a friend of mine asked me about it. This note is to summary my understand about it.

1 Recipe

ADMM deals with an optimization problem in the following form:

$$\begin{aligned} \text{minimize} \quad & f(x) + g(z) \\ \text{subject to} \quad & Ax + Bz = c \end{aligned}$$

Updating procedure:

- abc
- df

2 Derivation

It's not really a derivation but rather a step by step how to get to the procedure above.

1. The augmented Lagrangian function:

$$L_\rho(x, z, y) := f(x) + g(z) + y^T(Ax + Bz - c) + \frac{\rho}{2} \|Ax + Bz - c\|_2^2$$

2. The dual function:

$$g(\rho) := \inf_{x,z} L(x, z, \rho)$$